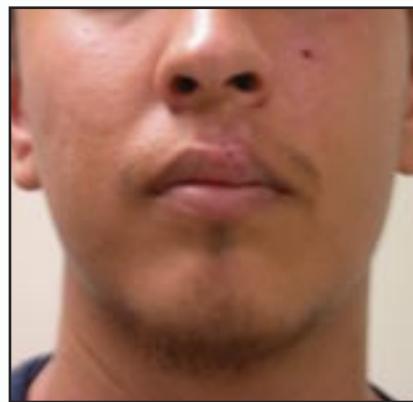


# The HELP Guide to Basics of Wound Care



Nadine B. Semer MD, FACS

**Editor**  
**Hugh G. Watts MD**

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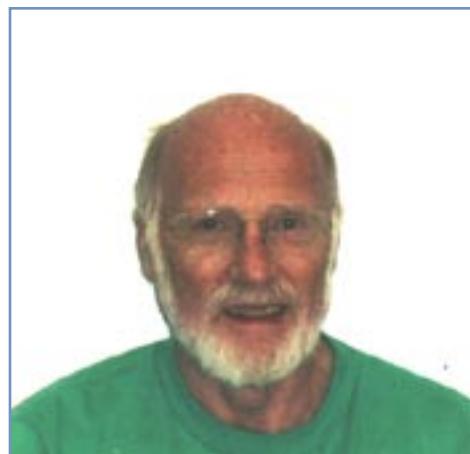
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## Introduction

A common treatment provided by rural health care providers is wound care. Whether it is a fresh acute wound or a chronic longstanding wound the basic treatment is the same, only your initial approach to the wound changes.

This HELP publication will present the basic information for evaluating both acute and chronic wounds and then providing the appropriate care.

This publication does NOT cover Life-Threatening Injuries.

## Evaluating an open wound

**First Question:** *Is it Life-Threatening?* A life-threatening wound would be, for example, a chest wound- where the underlying lung could be injured, an abdominal wound that could involve the contents of the abdominal cavity, a wound with very active bleeding, or a neck wound, which could compromise the patient's airway.

This publication does not cover Life-Threatening Wounds (refer to publications on Major Trauma Care for this information).

**Second question:** *Is it a fresh (acute) or longstanding (chronic) wound?*

For the purposes of this HELP guide, an acute wound is one that is less than a few days old, whereas a chronic wound is one that has been present more than a week.



Acute Wound



Chronic Wound

## Acute wounds

When evaluating a patient that comes to you with an acute wound, the first step is to control blood loss and evaluate the need for other emergency procedures. This information is beyond this HELP guide. This HELP guide describes treatment for a basic, non-life threatening wound- one without any chance for significant internal injury (i.e., pneumothorax, intra-abdominal, etc.).

Start by obtaining a thorough history- both pertaining to the patient and the events surrounding the injury.

## Patient information

**A. Tetanus immunization status and what to do:** (see chart next page).

**B. Bleeding at time of injury:**

Even if the patient is not actively bleeding at the time of evaluation, the history of bright red, pulsatile bleeding at the time of injury should alert you to the possibility of underlying arterial injury. Check pulses at and distal to the injury to be sure circulation is intact. Formal exploration in the operating room by a qualified clinician is usually warranted if you suspect an artery has been injured.

**C. Medical illnesses:**

Malnutrition, diabetes, HIV are a few common medical illnesses that can make a patient more prone to infection and warrant closer follow-up care. Encourage patients with diabetes to keep their blood sugar well controlled. Encourage adequate protein/vitamin intake vital for normal healing.

**D. Smoking history:**

The use of tobacco products dramatically slows the healing process. Strongly encourage your patients to quit smoking immediately.

## Tetanus immunization status and what to do:

Years since immunization	Wound*	Tetanus treatment**
< 5	Clean or Tetanus prone	no further immunization needed
>5 <10	Clean	no further immunization needed
>5	Tetanus prone	Tetanus toxoid 0.5ml IM
>10	Clean or tetanus prone	Tetanus toxoid 0.5ml IM
Never immunized	clean	Start full tetanus toxoid immunization regimen (0.5ml IM; repeat in 4 wks and 6-12 mo after second injection).
Never immunized	Tetanus prone	Start full tetanus toxoid immunization regimen (0.5ml IM; repeat in 4 wks and 6-12 mo after second injection). Human tetanus immunoglobulin 250 U, deep IM- not in the same area as the toxoid shot.

\* see **tetanus-prone wounds page 5**  
 \*\* a thorough cleansing of the wound is indicated for all wounds

## Events surrounding the injury

### A. Timing of injury: when did the injury occur?

If less than 6 hours between injury and evaluation, the wound can usually be sutured closed. If more than 6 hours have passed, the wound should not be closed due to high infection risk. EXCEPTION: due to cosmetic concerns and because the face has an excellent blood supply, face wounds may be closed even 24 hours after injury.

### B. Nature of Injury:

Nature of Injury	Notes
Animal bite	Cat bites penetrate deeper than other animals (dogs for example) and especially on the hand often enter deep joints- associated with a high infection rate. Be aggressive in cleaning the wound and treating with antibiotics.
Human bite	Especially to hand, high risk for infection. Be aggressive in cleaning the wound and treating with antibiotics. Use antibiotics that will treat anaerobic bacteria present in the human mouth.
Crush injury- example leg rolled over by a car tire, hand caught in a press	There is often more underlying damage than you may initially think. Don't be fooled if the skin looks uninjured- the muscle may be severely damaged.
Dirty wounds- covered with grass, dirt, etc.	Will need thorough debridement and removal of foreign material.

## Examining the wound

### C. Tetanus-prone wound- definitions:

Wound information	Is tetanus-prone	Is not tetanus prone
Time since injury	> 6 hours	<6 hours
Depth of injury	> 1cm	< 1cm
Mechanism of injury	Crush, burn, gun-shot, frostbite, penetration through clothing	Sharp cut
Dead tissue present	yes	no
Foreign material (grass, dirt, etc.) contamination	yes	no

### D. Rabies concerns:

Be aware of the rabies virus risk in the area where you are working. Some countries (England) have no rabies, but in most other countries rabies is a concern. Livestock (pigs, cows, goats), rodents (mice, squirrels, rats), rabbits are usually not associated with transmission of rabies. Bats, skunks, dogs, cats, raccoons, jackals, wolves are just a few animals that can harbor the rabies virus.

#### If you feel a patient is at risk for rabies:

1. *Thoroughly clean the wound-* irrigate it with saline, wash it with soap and water, and then apply alcohol or povidone iodine solution.

2. *Administer human rabies immunoglobulin* (20 IU/kg). Half of this should be injected in and around the wound. The rest should be given IM at the deltoid or outer thigh area (at a spot not used for vaccine injection).

3. *Rabies vaccine* 1.0ml IM in the deltoid area adult/older children, outer thigh (NOT gluteal area) in younger children. Repeat on days 3, 7, 14, and 28. Other regimens have been described.

<[www.who.int/emc-documents/rabies/whoemc-zoo966.htm](http://www.who.int/emc-documents/rabies/whoemc-zoo966.htm)>

4. Unless the wound is over a critical area, *don't suture the wound closed.*

5. Remember to *control for other infections* - give appropriate tetanus treatment and antibiotics.

### A. Need for debridement:

*Foreign material* for example grass, dirt, wood, clothing, must be removed from all wounds as they are sources for infection.

An exception to this rule is a needle or bullet deeply embedded in the tissues. In the absence of underlying injury or other need to formally explore the wound in the operating room, these foreign bodies can often be left in place- attempts at removal may cause more injury. They are also surprisingly difficult to locate without the assistance of x-ray equipment. Usually what happens is that the body will wall off these foreign materials and they will either stay in place without problem or may work their way to the surface or will become locally infected. When their presence is more noticeable, then removal is warranted.

*Obviously dead tissue:* Loose fat, skin purple in color, or tissue embedded with dirt should be sharply debrided (see "Sharp debridement" section page 12 for description).

### B. Cleansing the wound

All wounds should be thoroughly cleansed to allow full examination and subsequent closure. This will remove all loose particulate matter and decrease bacterial content. Remember, this can be painful, so whenever possible start by injecting local anesthetic around the wound.

The patient in **Photo A** fell off his bicycle a few hours ago. On first appearance, it looks as if the tissue in the center of his lip is dead. However, after giving local anesthesia and washing the wound, the black area was actually a blood clot. **Photo B** shows that no tissue was dead.



Irrigate the wound with several hundred cc of sterile saline. For puncture wounds- bites, etc., you may need to cut into the skin to enlarge the opening to thoroughly wash out the wound. When you have irrigated until no further particulate matter comes out and the wound looks clean, irrigate with 50-100 cc more just to be sure.

#### How to do it:

Don't just pour saline on the wound. To fully clean the wound there must be some pressure behind the flow of water. The simplest method is to create an irrigating device using a syringe (any size but 20-50 cc is easiest) with a blunt tipped needle or IV catheter on the end. **Photo A.** A 20 gauge is best, it may take longer for the fluid to come out compared with an 18 gauge, but it creates a higher force for better cleansing. A needle can be used, but be careful not to stick yourself or your patient.



After the wound has been thoroughly irrigated, gently apply povidone or other antiseptic solution. Although these solutions can be harsh to the tissues, it is useful to gently wipe the wound and the surrounding skin with the solution to further clean the wound. The wound is now ready for further treatment.

## Evaluate for any underlying injury- vascular, bone, nerve, etc.

#### A. Vascular injury

If the injury is near a pulse point- for example, above the volar (palmar or anterior surface) wrist, check to see if you can feel the radial and ulnar pulses. Also check the circulation distal to the injury- in this example check that the fingers are pink with good capillary refill. Look for pulsatile bleeding from the wound (arterial injury) or dark red oozing (venous injury), or ask if there was pulsatile bleeding at the time of injury which has now stopped.

Any evidence of arterial injury- even if the wound is

not actively bleeding at the time of evaluation warrants urgent formal surgical exploration. An arteriogram, if available, may be indicated even if there is no definite sign of arterial injury if the wound is in proximity to an important vessel.

**One shot arteriogram: Inject IV contrast into nearby vessel. Ex. Suspect injury to superficial femoral artery in the thigh, inject into femoral artery and take an Xray as you inject. This is a very crude way to evaluate the vessel, if no formal arteriography equipment is available.**

#### B. Nerve injury

If an injury runs along the course of an important nerve, evaluate for nerve function. For example, an injury in the forearm warrants checking sensation distal to the injury and checking the function of muscles outside the zone of injury (example, forearm laceration, check intrinsic hand muscles to rule out an ulnar nerve injury). A nerve injury does not necessarily require immediate exploration- the wound can be closed in the short term, but formal exploration/repair should be done by a specialist as soon as reasonably possible.

#### C. Tendon injury

If an injury occurs over the course of a tendon, evaluate its action to be sure it is intact. Weakness/pain may be a sign of partial laceration. Again, a tendon injury does not require immediate repair- clean the wound and close the wound initially. Formal exploration can be done as soon as reasonable.

#### D. Fracture or joint dislocation

In patients with obvious bony deformity- x-rays are warranted. A wound over a fracture or dislocation, makes it an "open" or "compound" injury, (**Photo B**). An open fracture has a much higher chance for infection than a closed fracture (no open wound). Particularly if an orthopedic surgeon is not readily available, it is very important to thoroughly clean the wound, immobilize the fracture (reduce it if possible) and start the patient on intravenous antibiotics (a cephalosporin is usually good +/- gentamicin). If you can loosely close the skin, do so or just apply a sterile moist dressing until definitive care can be completed.



# Chronic wounds

Chronic wounds are wounds that for some reason just will not heal. They may be present for weeks or months or even years. You must evaluate the patient and the wound to try to determine why the wound won't heal. Once the cause is identified and appropriately treated, basic wound care (see "Basic wound care" section) should be instituted and healing should result.

The wound pictured in **Photo A** has been present for many months. There is a base of granulation tissue (the bright red tissue) which is covered by a layer of pale yellowish, protein rich material. The bright red ring around the wound does NOT represent infection. We know this because the skin just outside the ring is healthy- it's not warm or swollen. The red ring is an area of skin which has started to heal in around the wound. With proper care, this wound will eventually heal, but it may take a long time. Covering the wound with a split thickness skin graft will allow it to heal faster.



## Common underlying causes and their treatment

### A. Neglected wound/ poor basic care

Many wounds do not heal simply because they are inadequately cared for. All necrotic tissue must be removed, surrounding infection treated appropriately with antibiotics, and good basic wound care instituted.

#### *Foreign material in the wound:*

Foreign material (wood, glass, pebbles, metal) may cause a reaction in the tissues that prevents wound healing. Ask the patient about the events that caused the wound and this may point you in the direction of looking for foreign bodies. An x-ray may be helpful, but many materials are not seen on x-ray. The foreign material must be removed before the chronic wound will heal.



The patient in **Photo B** has a chronic wound on his thumb. This x-ray shows a piece of metal in the tissues, probably from a previous work injury .

#### *Infection:*

An infected wound will not heal. If the skin around the wound is red/warm/swollen/tender start the patient on antibiotics. If these signs of infection are not present, antibiotic treatment is usually not warranted. **See Photo B, page 9.**

### B. Chronic osteomyelitis

Consider infection of the underlying bone (called chronic osteomyelitis), particularly if there is a history of trauma or an open fracture. Chronic osteomyelitis is a real problem in the developing world. Because the infection in the bone prevents both the soft tissue and the injured bone from healing, it is a major cause of morbidity for patients who have sustained an open fracture. The patient usually requires 6 weeks of antibiotics and the bone must be debrided for healing to occur.



The patient in **Photo C** (previous page) has a chronic wound on the side of her knee. Several years earlier, she was in a car accident and had an open fracture of her tibia. The wound never healed properly. The underlying bone is infected and exposed. The entire area (infected bone and soft tissue) must be debrided before healing will occur.

### C. Tobacco use

Many people are unaware of tobacco's ill effects on wound healing. Nicotine decreases blood flow by clamping down on smaller blood vessels. Oxygen delivering capacity is also diminished due to carbon monoxide. This is particularly damaging to traumatized tissue and relatively hypoxic tissues such as bone. Encourage your patient to stop the use of all tobacco products.

### D. Cancer

A longstanding wound (present for months or years) that looks shiny and will not heal may be a cancer. Usually these wounds look a bit different than the usual open wound- edges are raised and more irregular, surrounding skin may be thicker. **See Photo Below.** Be aware that chronic wounds in a burn scar can turn into a virulent skin cancer- when in doubt, take a small biopsy of the tissue and have it evaluated by a pathologist. The cancer must be completely excised for healing to occur.



### E. Malnutrition

Malnutrition is a particularly difficult problem in rural areas. Adequate protein and calories are needed to promote wound healing. Vitamin C, A, iron, and zinc are also important nutrients for wound healing. If available, nutritional supplements for depleted patients are necessary.

### F. Diabetes

Patients with diabetes can be notoriously slow healers. Keeping good blood glucose control will promote healing.

### G. Medications

Look over your patient's medication list. Steroids and NSAID's can interfere with healing. Vitamin A 25,000IU/day orally or 200,000 IU/8 hours topically for 1-2 weeks may counter the effects of steroids.

### H. Radiation Therapy (XRT)

A wound in a previously irradiated field may take a very long time to heal. A short course (1-2 weeks) of oral Vitamin E supplementation (100-400 IU/day) may be useful.

### I. Poor circulation

For wounds on the lower extremities, feel for the pulses around the ankle and foot. If no palpable pulses are present, the patient has insufficient blood flow to the extremity and the wound may not heal.

# Basic Wound Care

## Initial Definitions

### A) A Clean Wound:

The skin surrounding the wound looks relatively normal as in **Photo A**. The skin is not tender to touch and not warm or swollen. If the wound is acute the exposed flesh will look normal. If it is an older wound, there may be a bed of granulation tissue (bright red tissue that bleeds if you try to wipe it off) over the wound. There should be no necrotic tissue overtop of the wound. There may be some fibrinous/proteinaceous material (exudate, see below) on the wound- but it is not creamy, like pus. Systemic antibiotics are not required for these wounds.

### B) An Infected Wound:

In an infected wound, the surrounding skin is often red and warm and swollen **Photo B**. There may be pus or other necrotic tissue on the wound. In general, an infected wound is more painful than a clean wound.

Systemic antibiotics and debridement are required if the wound is infected.

*It is important to distinguish between a clean wound and an infected one so as to know when systemic antibiotics are required. Just because someone has an open wound does not mean that antibiotics are necessary. Antibiotics are only required if the wound is infected.*



### C) Exudate:

the material that naturally builds up on wounds. It is made up of proteins, fluid, and cellular debris that gets to the wound from the surrounding tissue as a result of the healing process. This is not pus, **see Photo A, page 7**.

## Supplies

### A. Dressing materials

The best material for dressings is simple cotton gauze. You only need enough to lightly cover the wound. Be sure to open the gauze completely to prevent unnecessary waste of supplies.

Remember, there is nothing sterile about an open wound. Bacteria will always colonize the wound. Unless there is an important underlying structure (a prosthetic joint), clean technique is usually sufficient.

### Sterile technique vs. Clean technique

*Sterile technique* uses instruments and supplies that have been specifically treated so that no bacterial or viral particles are present on their surfaces. Instruments autoclaved for use in the operating room or gauze/gloves individually packaged at the factory are examples of sterile equipment.

*Clean technique* uses instruments and supplies that are not as thoroughly treated. Nonsterile gloves or gauze usually come with many in a single box. Clean supplies are much less expensive and easier to store than sterile ones and save valuable resources when appropriately used.

### D. New wound care products

There are many very good new wound care products available, but they are very expensive and not readily available throughout the world. These will not be discussed.

## B. Solutions

Various solutions are appropriate for wound care. These same solutions can be used to cleanse the wounds at the time of dressing change.

Solution	Preparation	Notes
<b>Povidone iodine</b>	Comes pre-made in containers. Best diluted for dressings: 1 part povidone iodine to at least 3 or 4 parts saline or sterile water.	Toxic to healthy tissues; best used in diluted form for only a few days- then change to a milder solution. Safe on the face and around the eyes.
<b>Saline</b>	Comes pre-made, but easy to make yourself. To 1 liter of water add 1 tsp salt. Boil the solution for at least 60 seconds and allow to cool. Store in a closed, sterile container and refrigerate if possible. Good for several days.	Safe anywhere on the body.
<b>Sterile water</b>	Boil a liter of water for at least 60 seconds and allow to cool. Store in a closed, sterile container and refrigerate if possible. Good for several days.	Safe anywhere on the body.
<b>Dakin's solution</b>	Some pharmacies keep Dakin's solution in stock, but it is easy to make. To 1 liter of saline solution, add 5-10 cc of liquid bleach. Store in a closed, sterile container and refrigerate if possible. If your pharmacy carries Dakin's solution, it's best used diluted: 1 part Dakin's solution mixed with 3-4 parts saline.	Better antibacterial agent than saline- so a little harsher on normal tissue. Do not use around the eyes. Makes wounds smell better.

## C. Antibiotic ointments

Some wounds, for example a burn wound, are best treated with a topical antibiotic ointment. The ointment keeps the wound moist and helps decrease the pain associated with a wound that has dried out. Also, the antibiotics can penetrate the wound and prevent infection.

## Dressing techniques

The following dressing techniques are easy to do and require no sophisticated equipment. Clean technique is usually sufficient. Pain medication may be required as dressing changes can be painful. Gently cleanse the wound at the time of dressing change.

### A. Wet-to-dry

*Indication:* to clean a dirty or infected wound.

*Technique:* Moisten a piece of gauze with solution and squeeze out the excess fluid. The gauze should be damp, not soaking wet. Open the gauze **Photo A** and place it overtop of the wound to cover it **Photo B**. You do not need many layers of wet gauze. Place a dry dressing overtop. The dressing is allowed to dry out and when it is removed it pulls off the debris. It's ok to moisten the dressing if it is too stuck.

*How often:* Ideally, 3-4 times per day. More often on a wound in need of debridement, less often on a cleaner wound. When the wound is clean, change to a wet-to-wet dressing or an antibiotic ointment.



### B. Wet-to-wet

*Indication:* to keep a clean wound clean and prevent build-up of exudates.

*Technique:* Moisten a piece of gauze with solution and just barely squeeze out the excess fluid so it's not soaking wet. Open the gauze and place it overtop of the wound to cover it. Place a dry dressing overtop. The gauze should not be allowed to dry or stick to the wound.

*How often:* Ideally, 2-3 times a day. If the dressing gets too dry, poor saline over the gauze to keep it moist.

### C. Antibiotic ointment

*Indication:* Antibiotic ointment is used to keep a clean wound clean and promote healing.

*Technique:* apply ointment to the wound- not a thick layer, just a thin layer is enough. Cover with dry gauze.

*How often:* 1-2 times per day.

### D. When to do which dressing

*Remember, the goal is to promote healing. We know that a moist environment facilitates healing.*

- *For a clean wound, it is best to use a wet-to-wet or ointment based dressing*

- *For a wound in need of debridement the wet-to-dry technique should be done until the wound is clean and then change to a different dressing regimen.*

- *For a wound covered with necrotic tissue, dressings cannot take the place of mechanical debridement. When present, necrotic tissue must be sharply debrided (although there are some preparations than work to dissolve necrotic tissue, they are very expensive and not readily available in rural settings) and then the wound treated with appropriate dressings.*

## Sharp Debridement

When a wound is covered with black, dead tissue or thick gray/green debris, dressings alone may be inadequate. Surgical removal- sharp debridement- is necessary to remove the dead tissue to allow healing.

### Technique

- Sedation or general anesthesia may be required. However, usually the dead tissue has no sensation, so debridement may be done at the bedside or in the outpatient setting.
- **Photos A & B:** Using a forceps, grasp the edge of the dead tissue and use a knife or sharp scissors to cut it off of the underlying wound.  
Bleeding tissue is healthy, so cut away the dead stuff until you get to a bleeding base.
- The patient may only tolerate this for a short period of time. Additionally, you don't want to cut off tissue that may be viable. So, you may have to do this a little at a time, and repeat this procedure as needed until all of the necrotic tissue has been removed.
- **Photo C** shows the wound after three weeks of wet-to-dry dressings.



# Appendix

## Wound closure options- reconstructive ladder

Plastic surgeons have organized wound closure options into a reconstructive ladder. The beginning ones are the simplest and require least amount of expertise. If the first steps don't work, proceed up the ladder to more complicated techniques. Unfortunately, they often require expertise that is beyond the basics of this guide to explain.

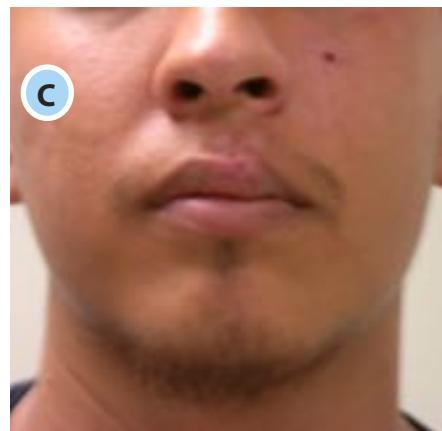
**1. secondary closure**- leave the wound open and do local wound care. The wound heals on its own.

**Photo A** shows the initial wound. **Photo B** after two weeks of antibiotic ointment dressings.

**Photo C** shows the final healed wound.



**2. primary wound closure-** suture the wound closed.



**3. delayed primary closure** - a good option for a wound that is too swollen to suture together at the time of injury or for a wound that you worry may become infected. Initially the wound is thoroughly cleaned and covered with saline moistened gauze. The dressing is left in place for 24-48 hours and then the dressing is removed. Usually within this time-frame, the swelling has subsided and you can tell whether there is infection. If the wound is clean and

the skin can be brought together without it being too tight, the wound is sutured closed. (**Photo D**) It is often useful to put a drain in the wound (place a penrose drain or a piece of sterile glove in the wound and have one end come out through the suture line, **Photos E and F**). This drain will prevent fluid from collecting under your repair. Remove the drain in 24-48 hours. Orthopedic surgeons commonly use this technique.



**4. skin graft-** harvest the top layers of skin from a distant sight (usually the thigh) to cover a wound. Split thickness skin grafts (STSG) takes just a portion of the dermis; full thickness skin grafts (FTSG) takes full thickness skin. Usually in a traumatic wound a STSG works better, since it is thinner and “takes” more easily. Neither type of skin graft will take over exposed tendon or bone if its thin layer of connective tissue covering is not present. **Photo A** shows an open wound on the foot. **Photo B** shows an STSG sewn in place. The suture ends are left long to tie the dressing into place, see **Photo C**. **Photo D** shows the final result two months later.



**5. local flap-** tissue (skin or muscle) near the wound is moved over to provide coverage for the wound. The donor site is usually closed primarily, but sometimes requires STSG or secondary closure.

**6. distant flap-** if there is no local tissue available to cover a wound, tissue can be taken from a distant sight. Example- burying a hand with a wound into the groin and detaching it later, or taking tissue from the abdomen and completely removing it from the body and moving it to the leg to cover an open fracture (this is a free flap- the vessels to the tissue must be reconnected to vessels in the leg).

*The method chosen for wound closure often is determined by the characteristics of the wound. A wound greater than 6 hours old should usually not be sutured closed, unless it is on the face. Just treat it with dressings. A wound with exposed tendons, bone, or other vital structure will need closure- primary closure is best. Sometimes delayed primary closure can be tried. If this is not possible due to the nature of the injury a skin graft or some type of flap will be required to prevent loss of the important structures. If you cannot provide tissue coverage for the wound, the best thing is to thoroughly clean the wound, cover with a sterile dressing and try to get the patient to the appropriate provider in a timely fashion.*



Global-HELP Publication

## Summary

**Wounds are common problems for people throughout the world. Without proper treatment, significant disability can result. A good understanding of basic wound care principles will help your patients to heal as quickly as possible with the best outcome.**

**This HELP publication provides practical information for evaluating patients with wounds. Treatments using techniques and supplies accessible to rural health care providers are discussed. By understanding the principles described in this HELP publication, a patient such as the one shown here- who accidentally cut off his fingertips with a saw can be successfully treated.**



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